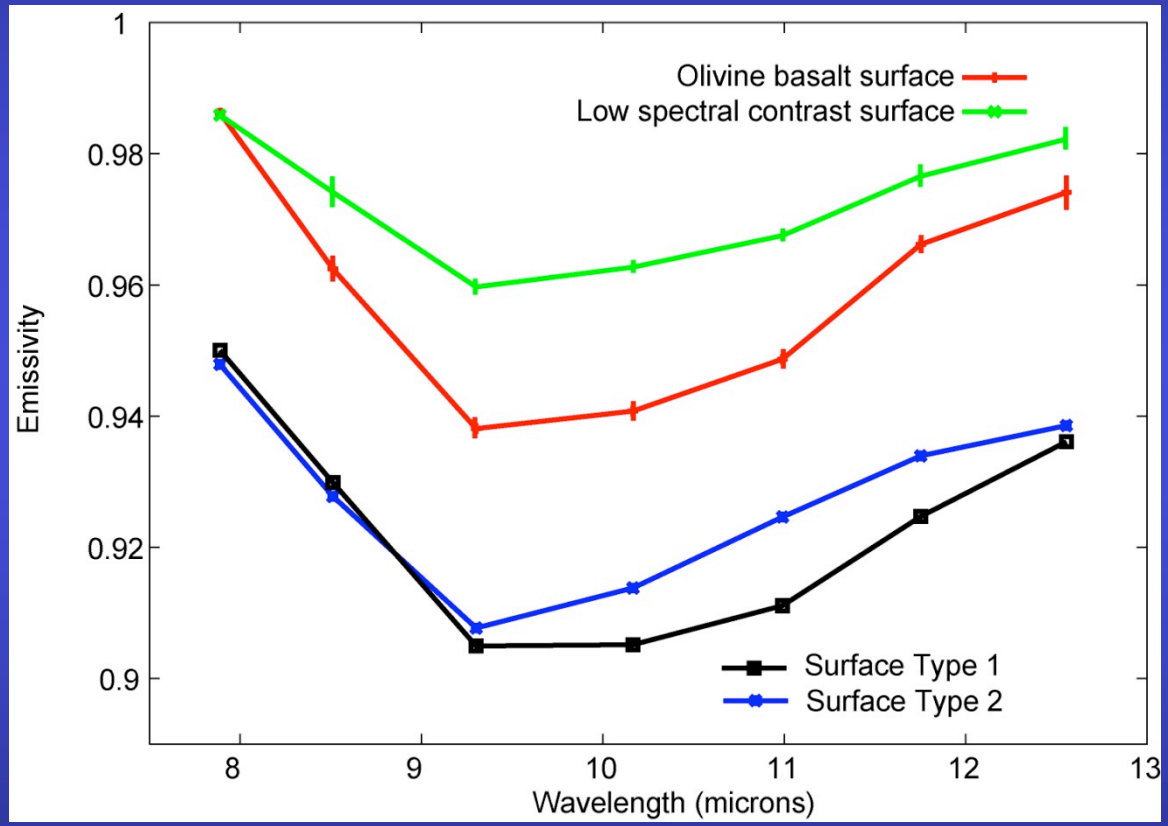
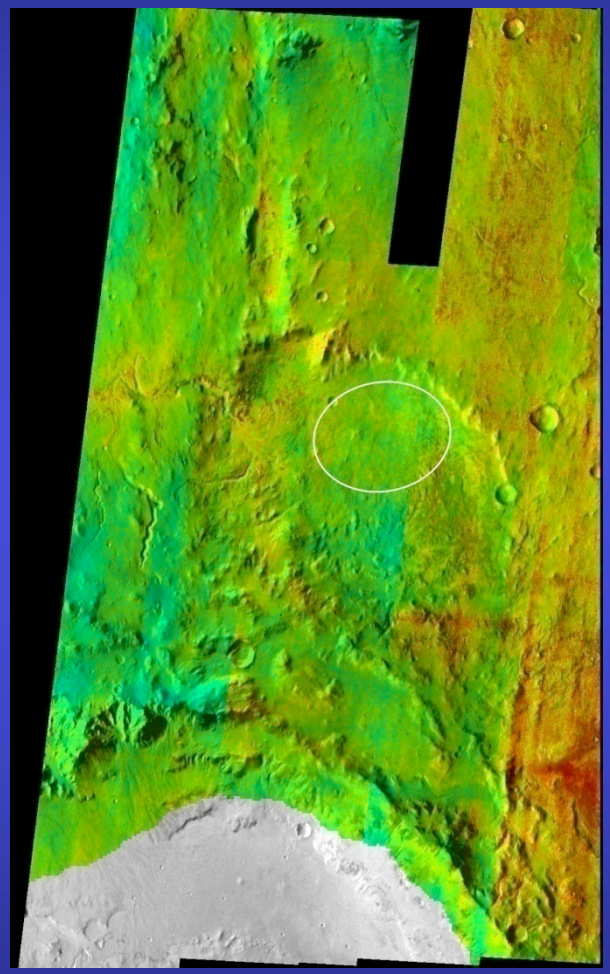
Eberswalde THEMIS spectral endmembers

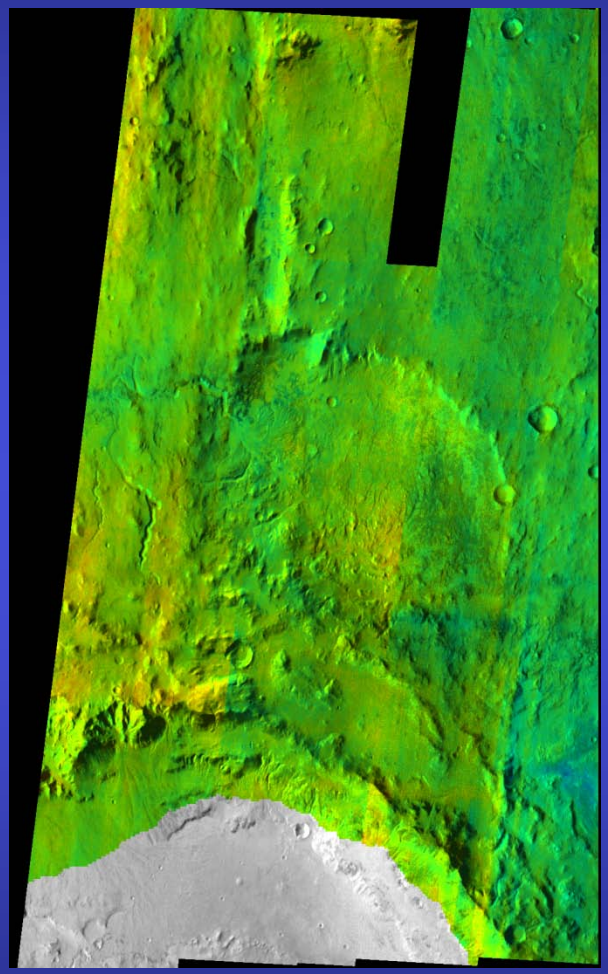
- Olivine basalt surface is similar to TES Surface Type 1
- Blackbody distribution represents varying contributions from dust or particle size/surface texture



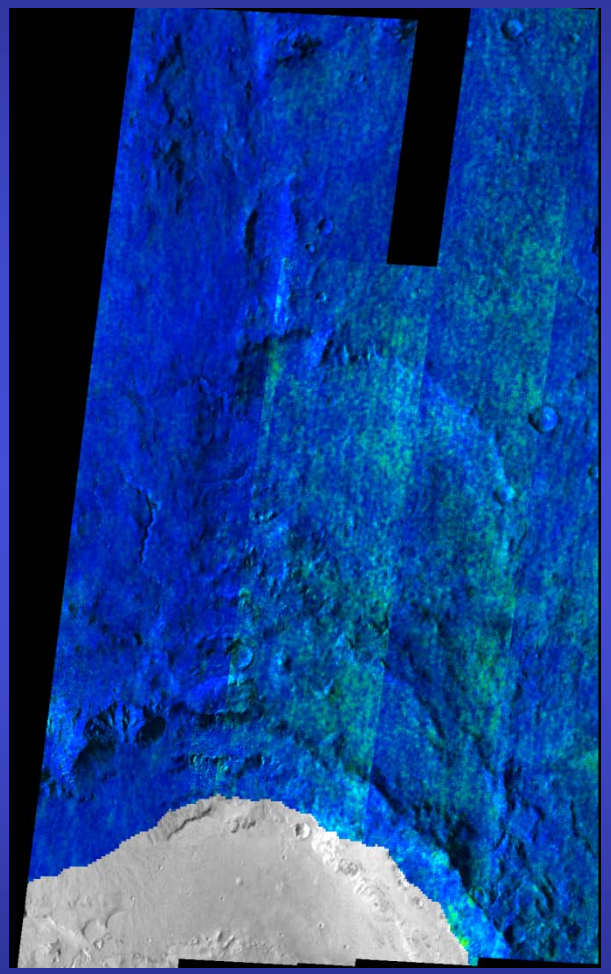
THEMIS spectral unit mosaics



Olivine basalt (0-1.5)

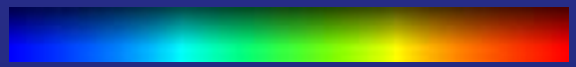


Blackbody (-1 to 1)



RMS Error (0-0.01)

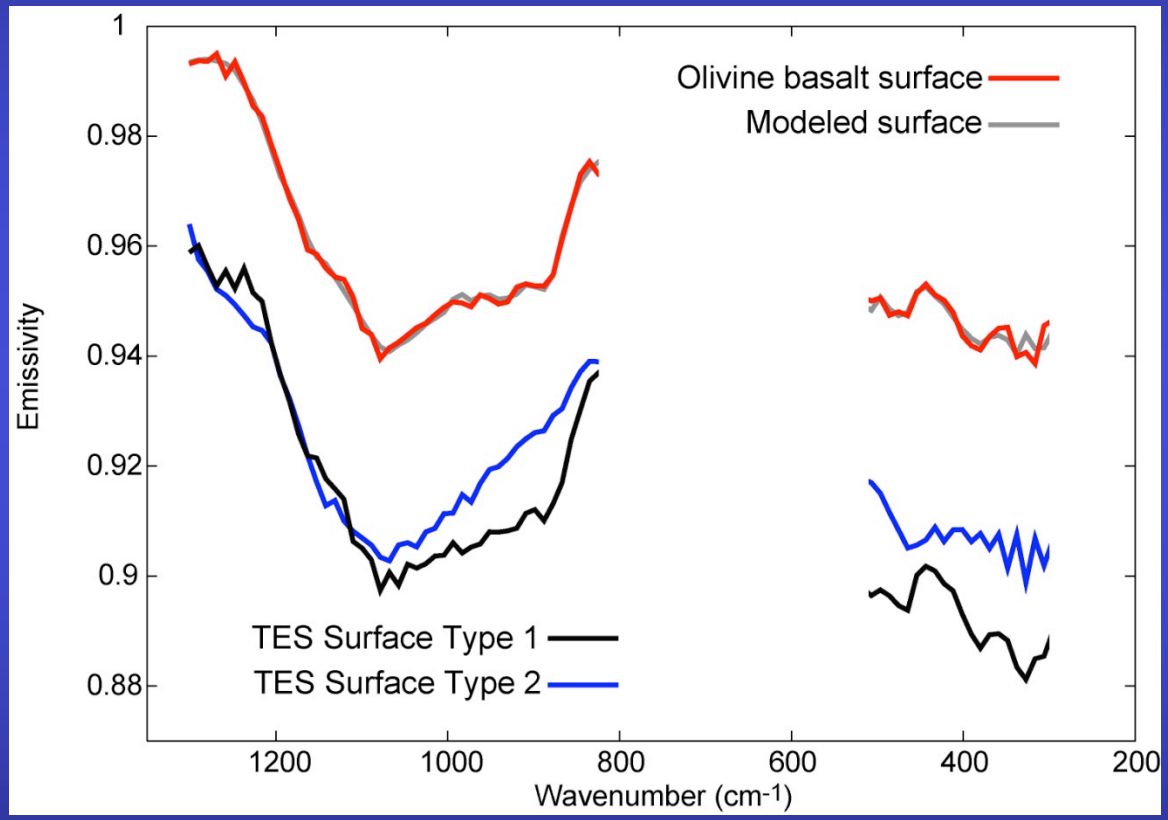
Data below -1650 m excluded



Eberswalde

TES analysis of THEMIS spectral units

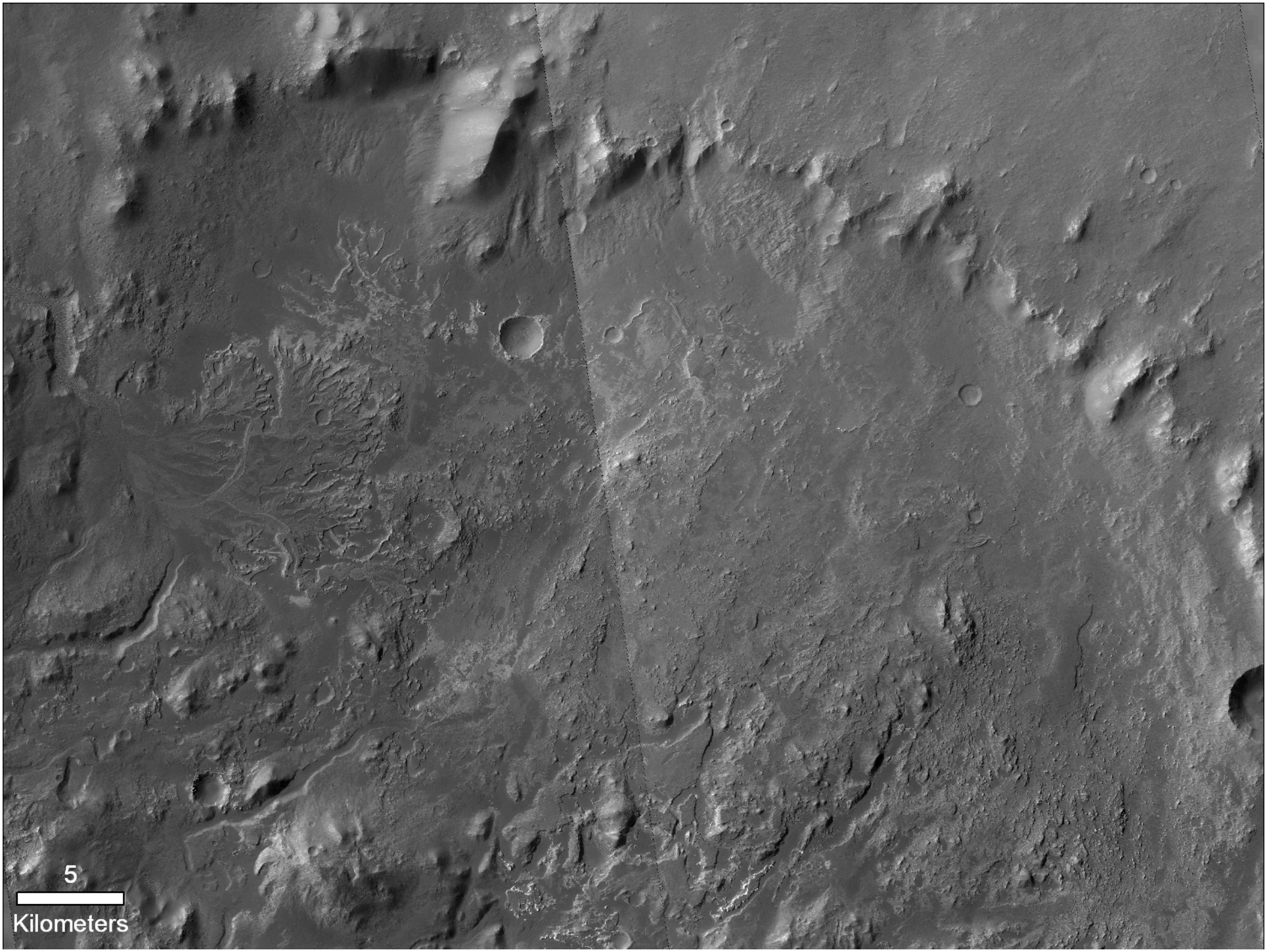
- Surfaces have significant plagioclase, pyroxene, high-silica phases, and olivine (~15-30%)
- Low albedo surfaces may be slightly altered

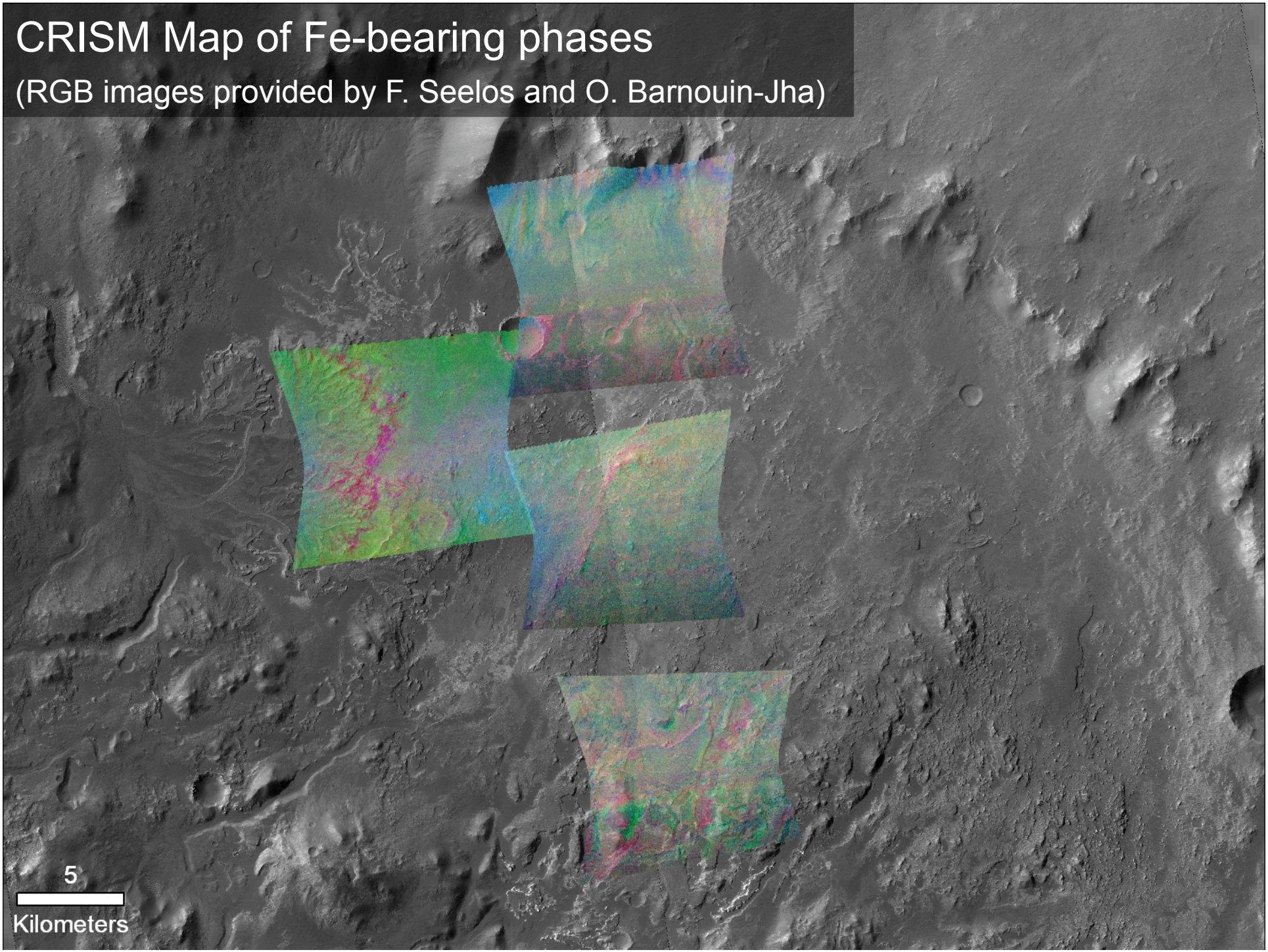


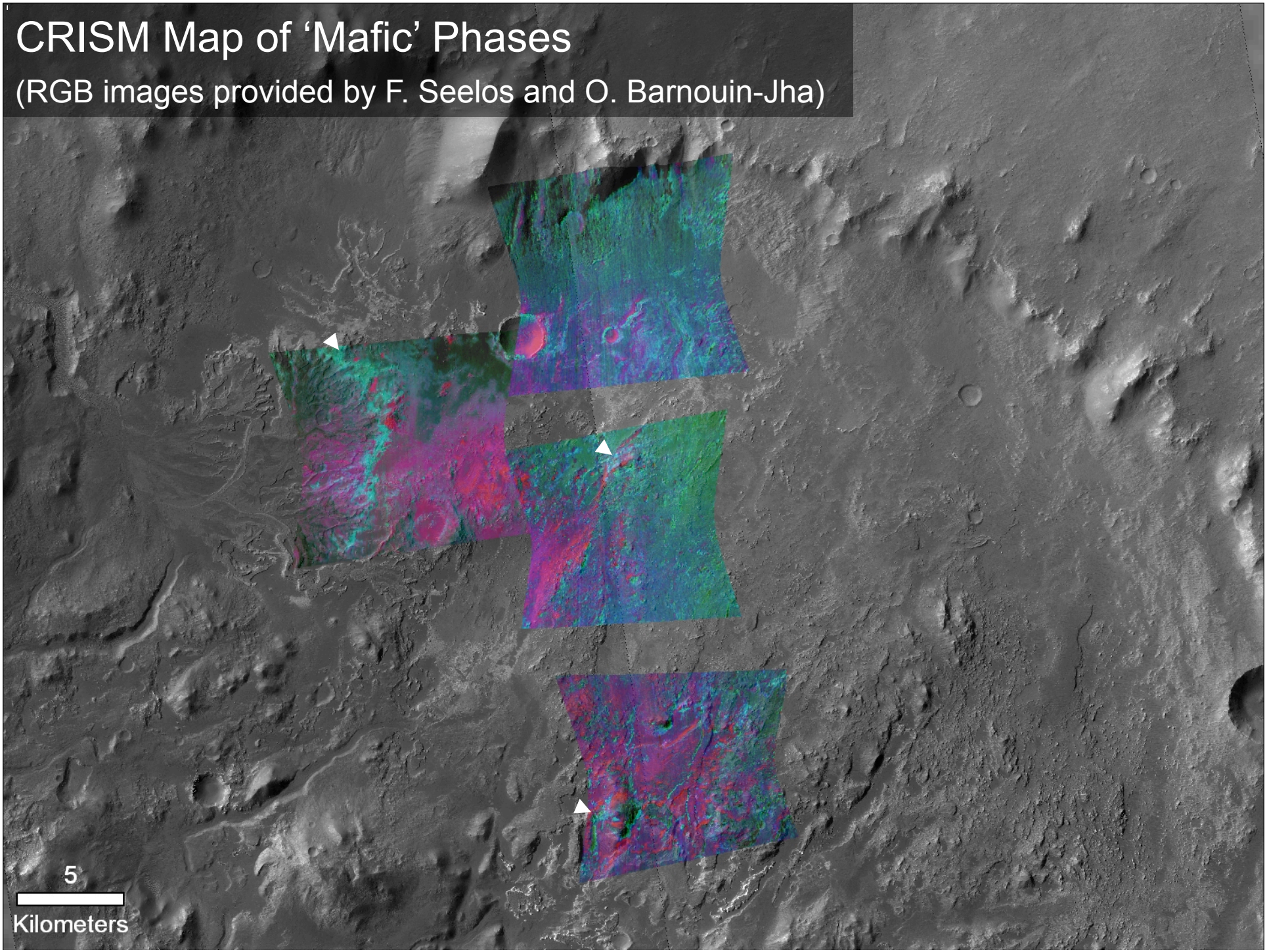
Eberswalde

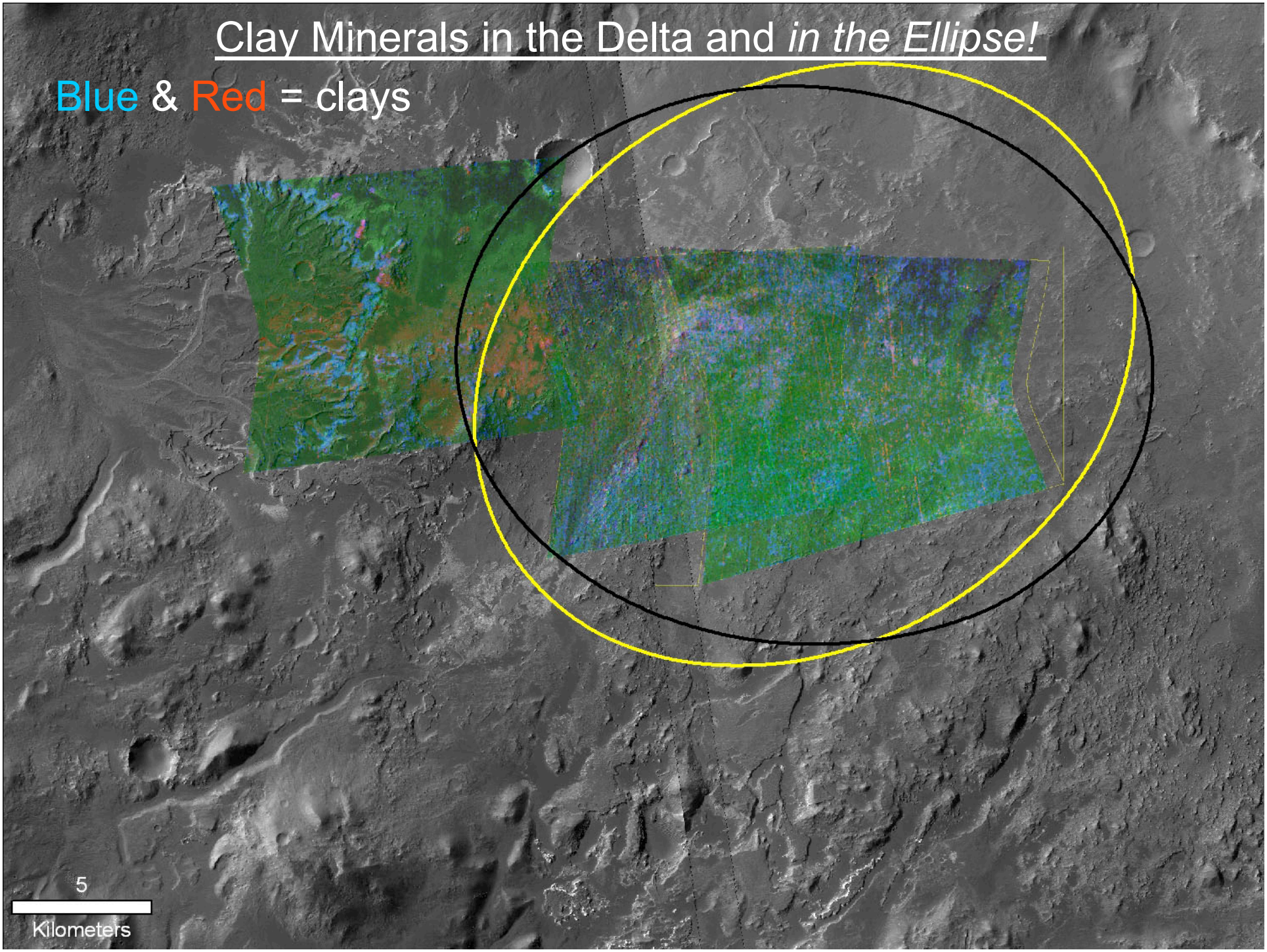
Summary

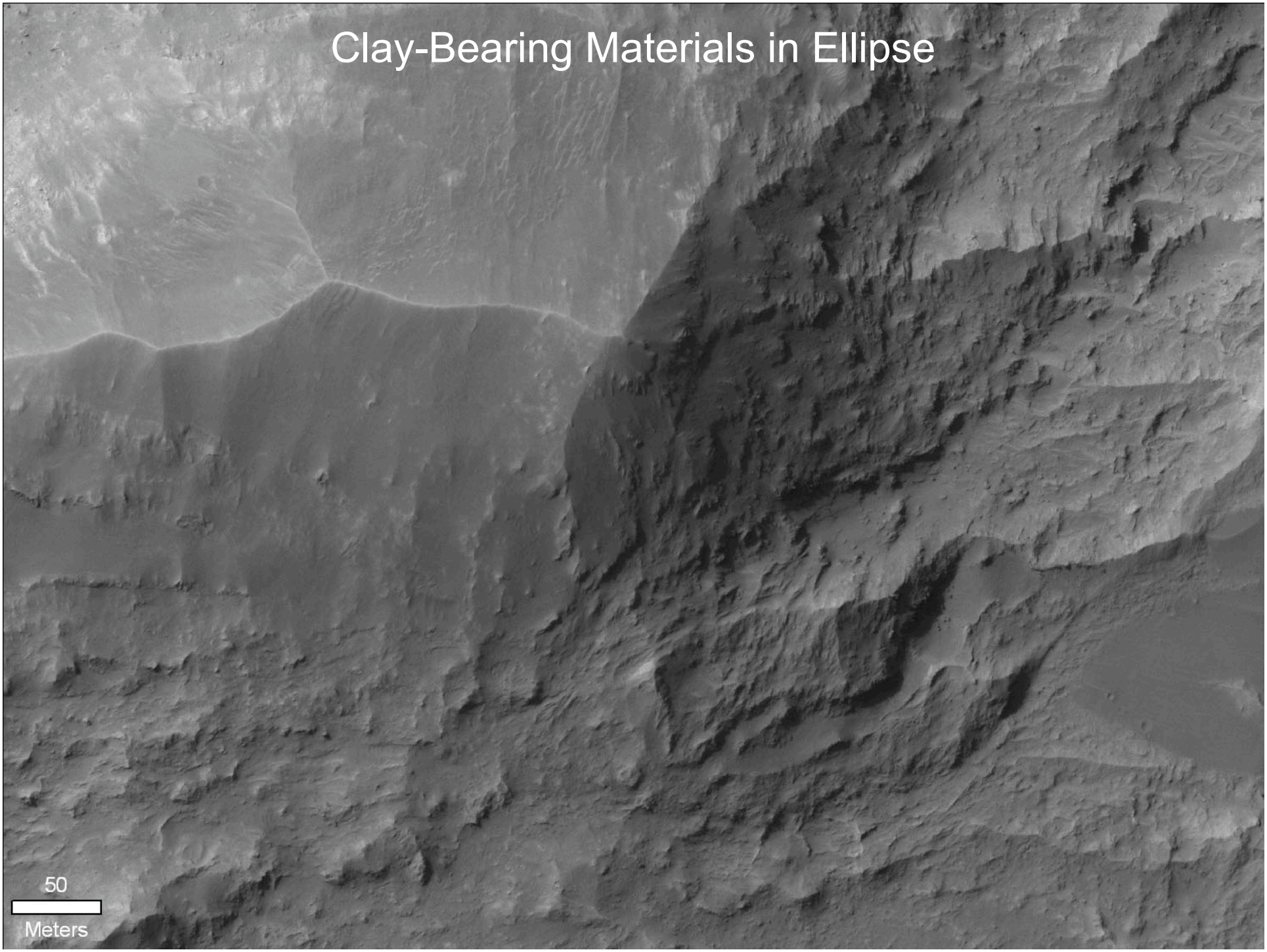
- Olivine basalt THEMIS spectral unit is relatively uniform across the region
  - Similar to many other southern highlands low albedo regions
- Little dust cover is present in the region


5
Kilometers


CRISM Map of Fe-bearing phases
(RGB images provided by F. Seelos and O. Barnouin-Jha)
5
Kilometers

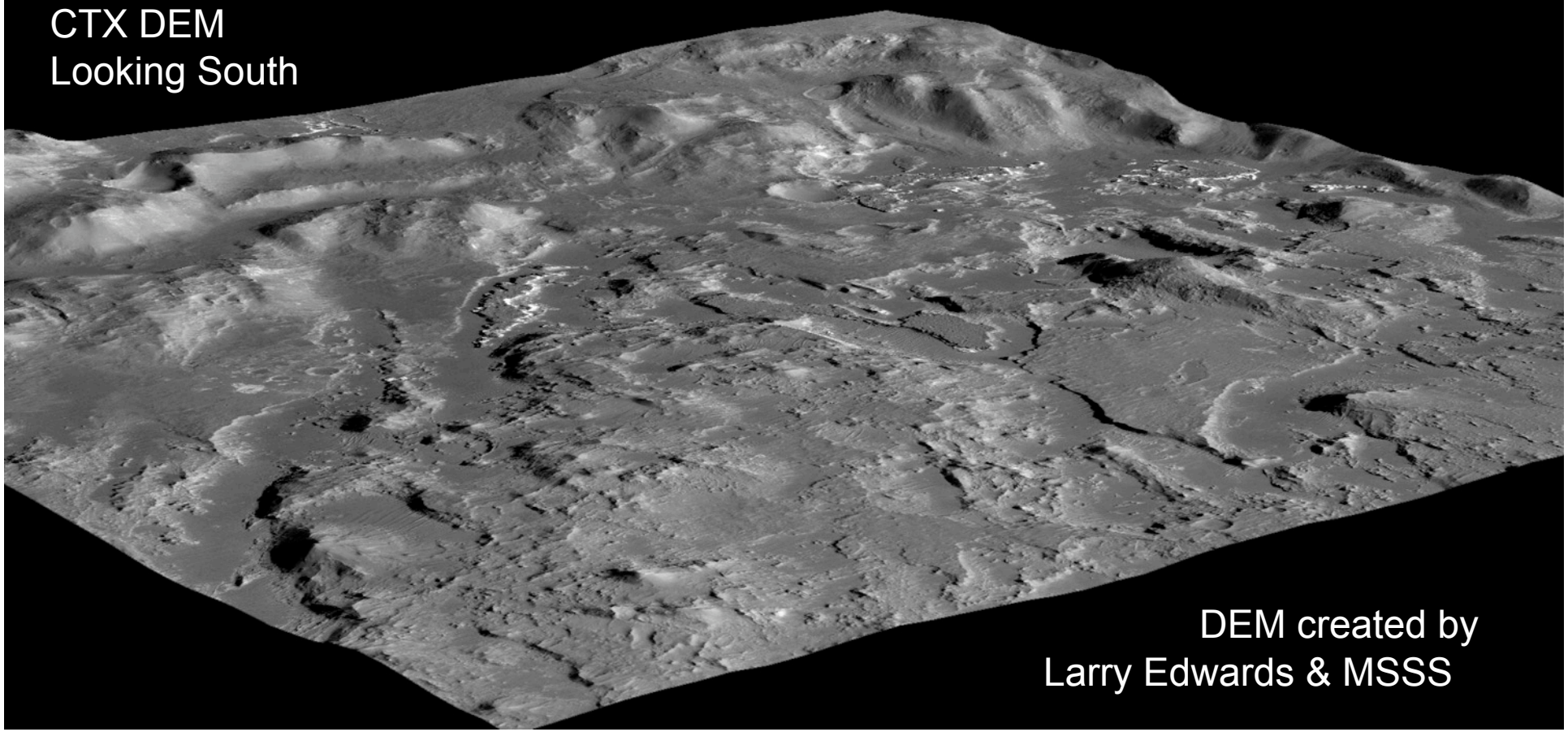

CRISM Map of ‘Mafic’ Phases
(RGB images provided by F. Seelos and O. Barnouin-Jha)
5
Kilometers

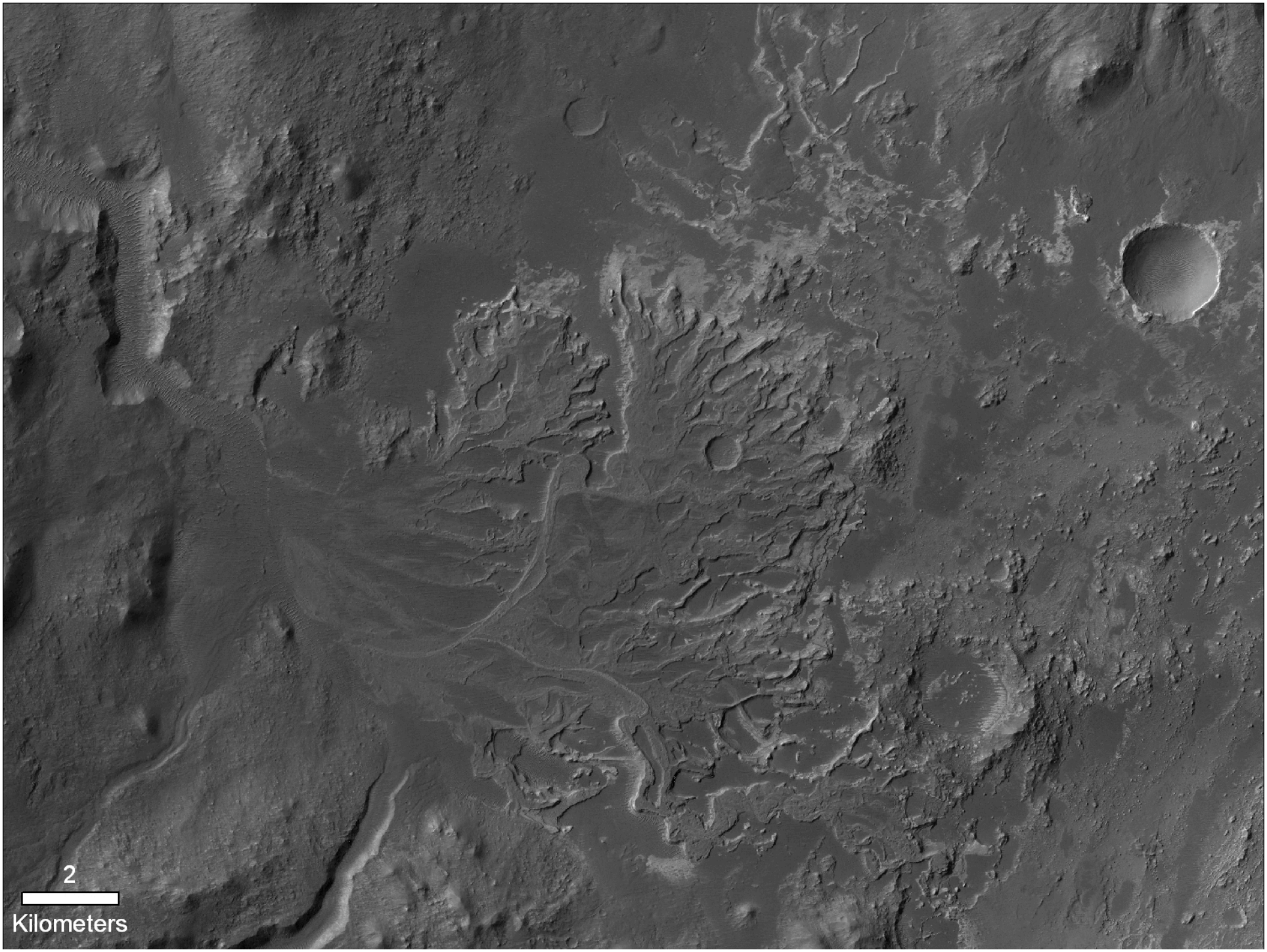

Clay Minerals in the Delta and *in the Ellipse!*
Blue & Red = clays
5
Kilometers

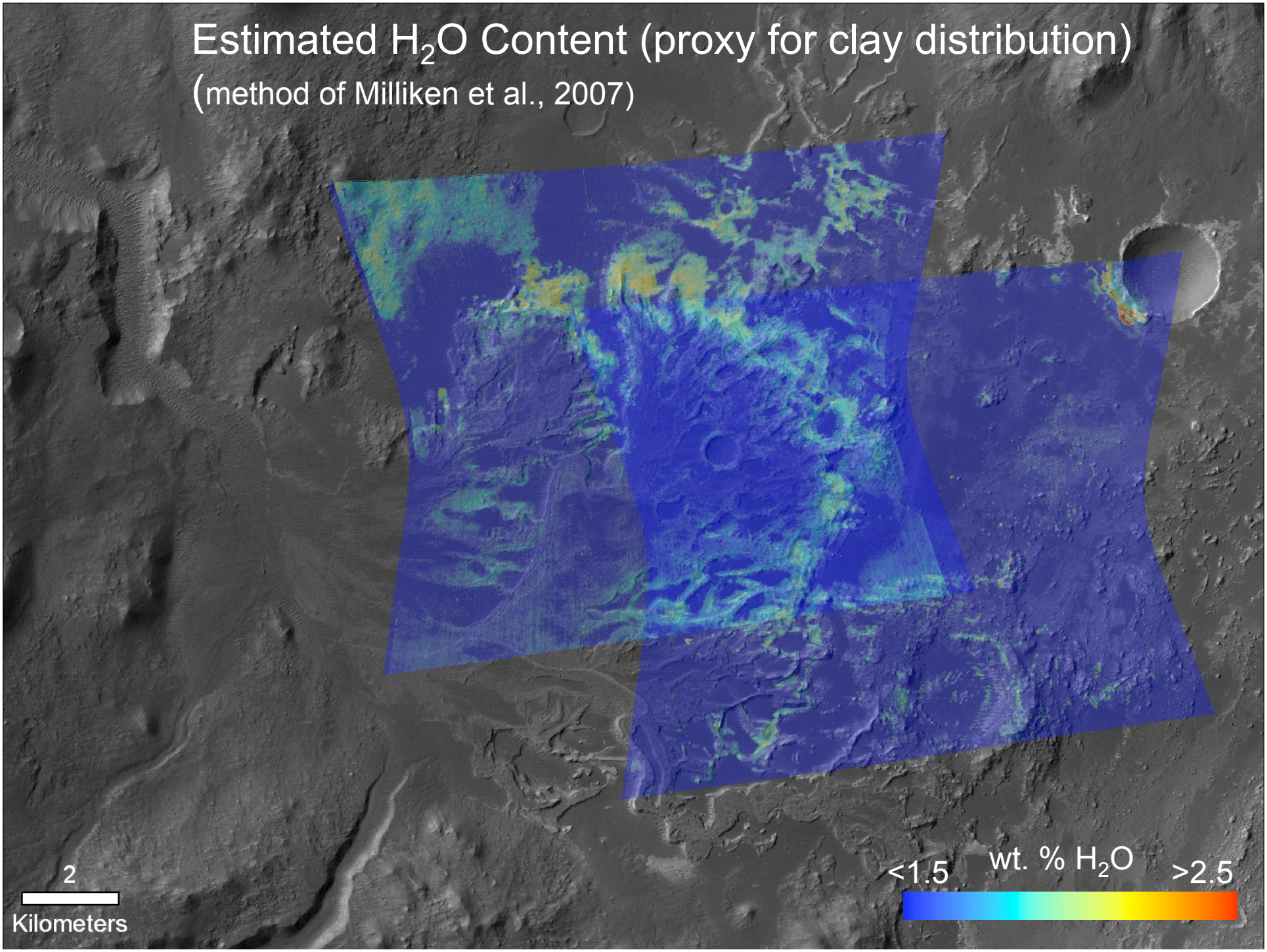

Clay-Bearing Materials in Ellipse
50
Meters

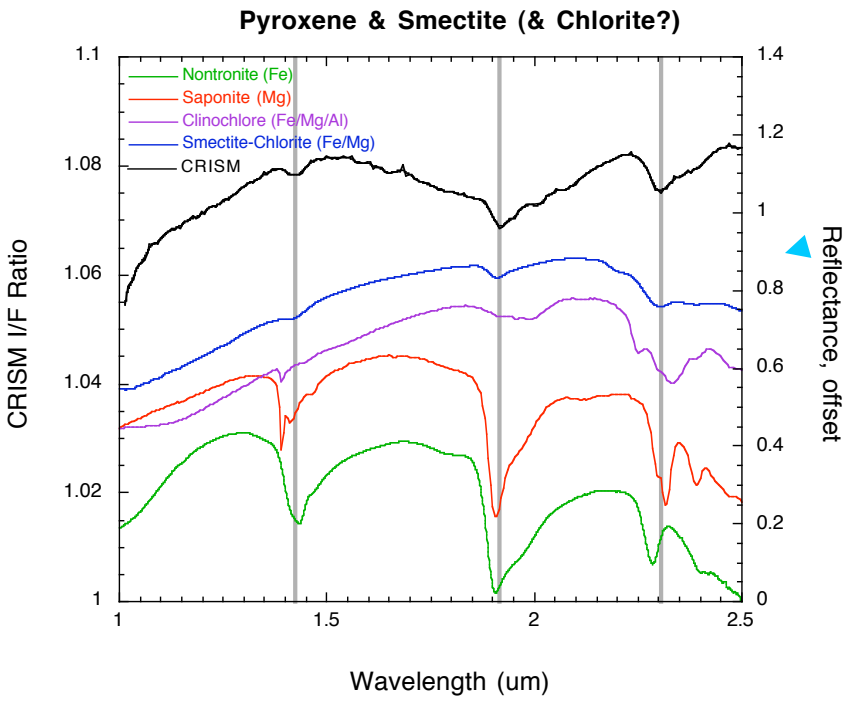
Exposures of clay-bearing strata are also located directly south of the landing ellipse.

These units do not appear to be contiguous with the delta. They are most likely sediments deposited by the fluvial systems along the southern rim.




2
Kilometers


Estimated H_2O Content (proxy for clay distribution)
(method of Milliken et al., 2007)
2
Kilometers
<1.5
wt. % H_2O
>2.5

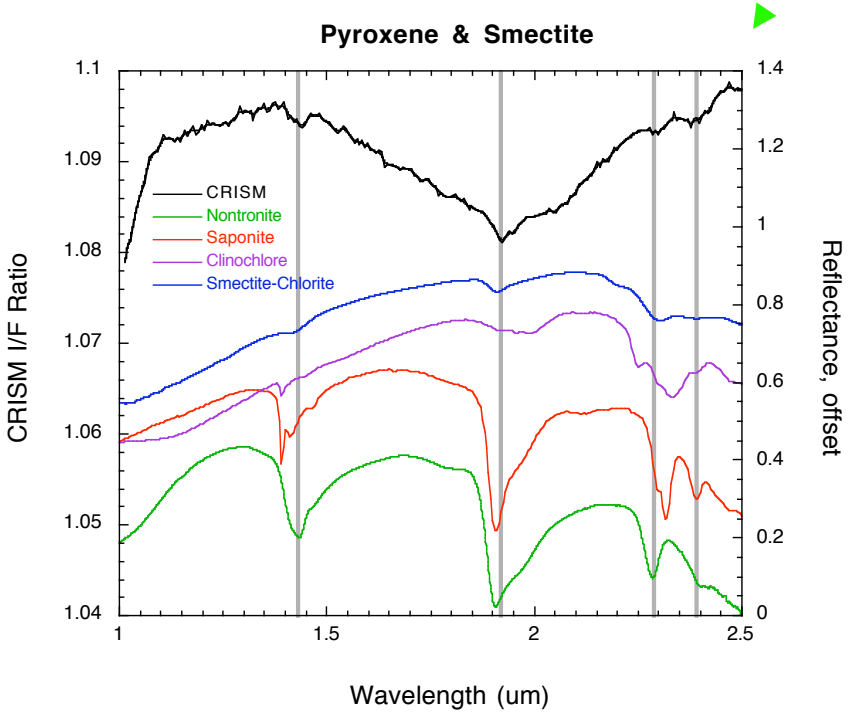


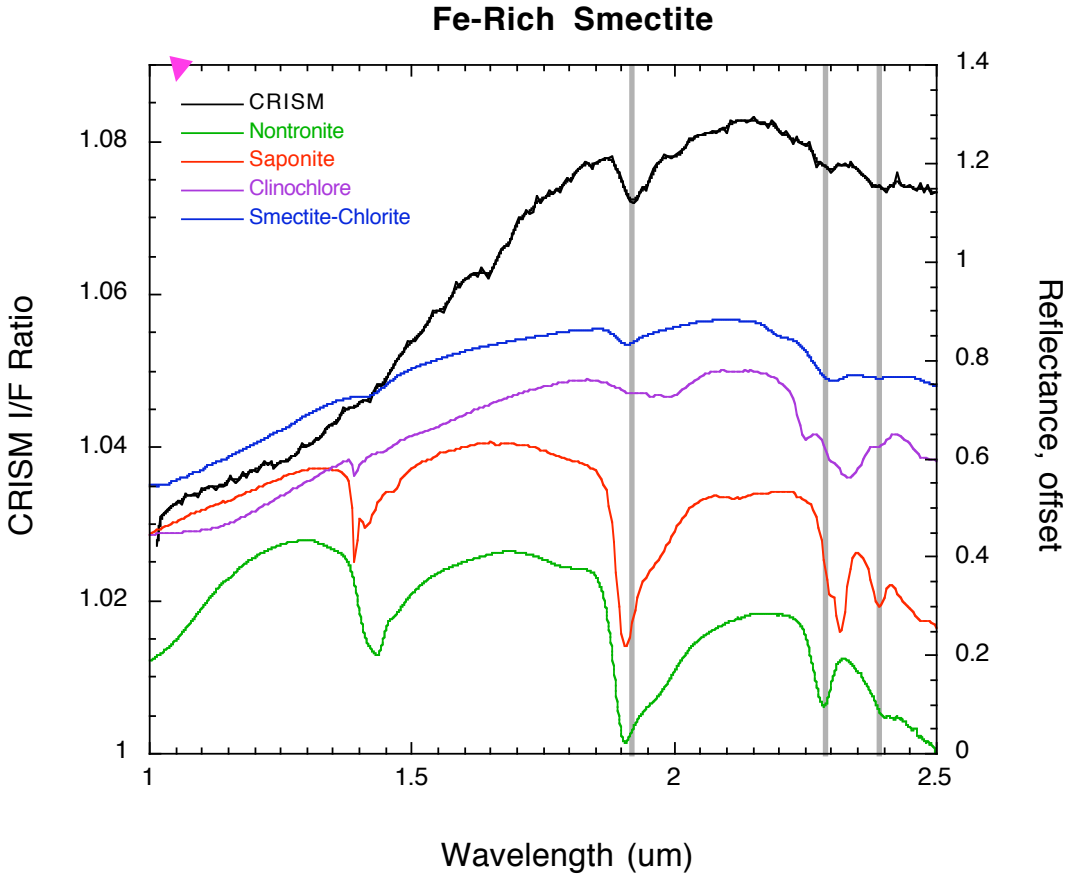
There are at least 3 distinct units:

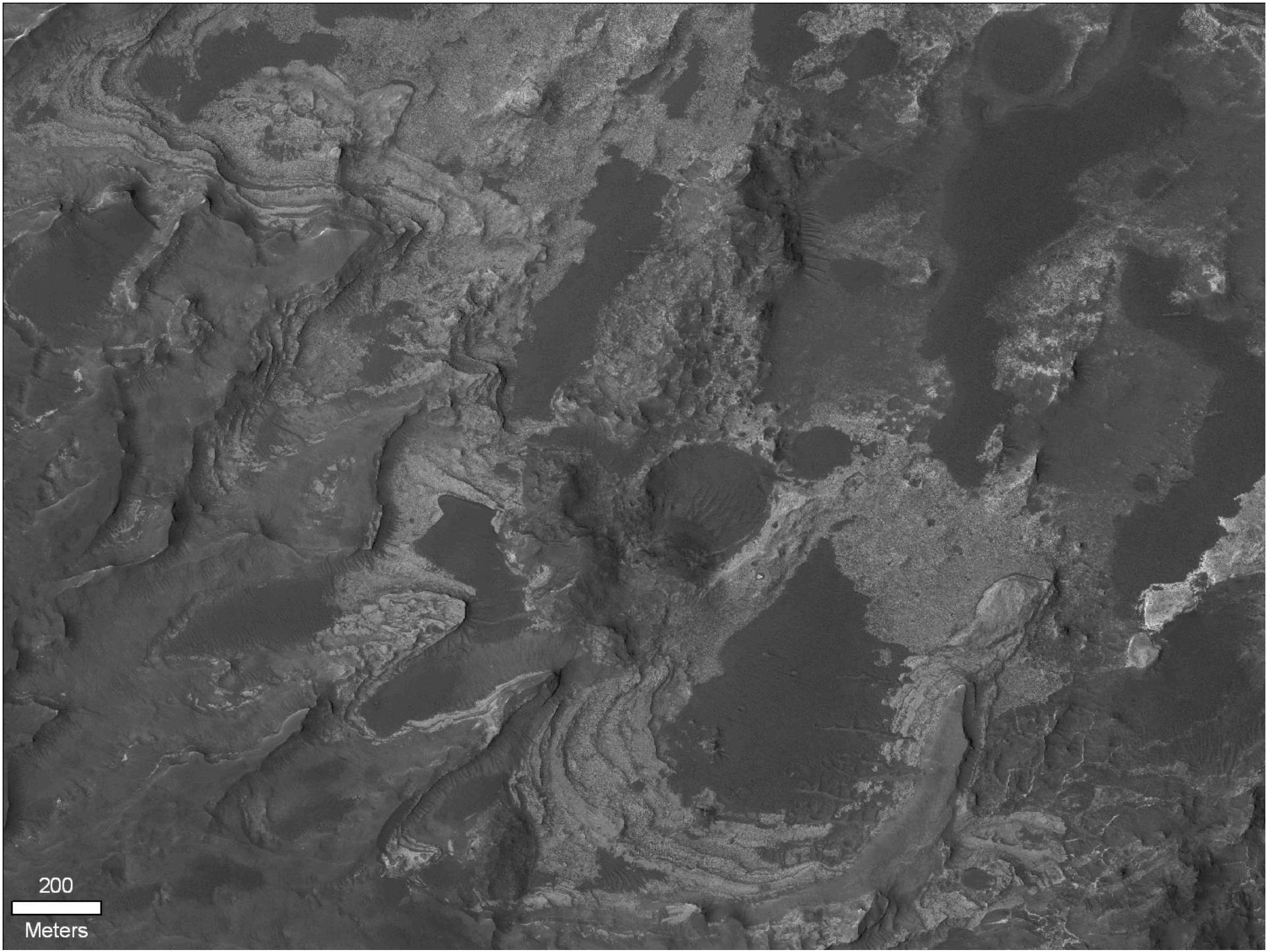
-Clay-bearing unit with pyroxene

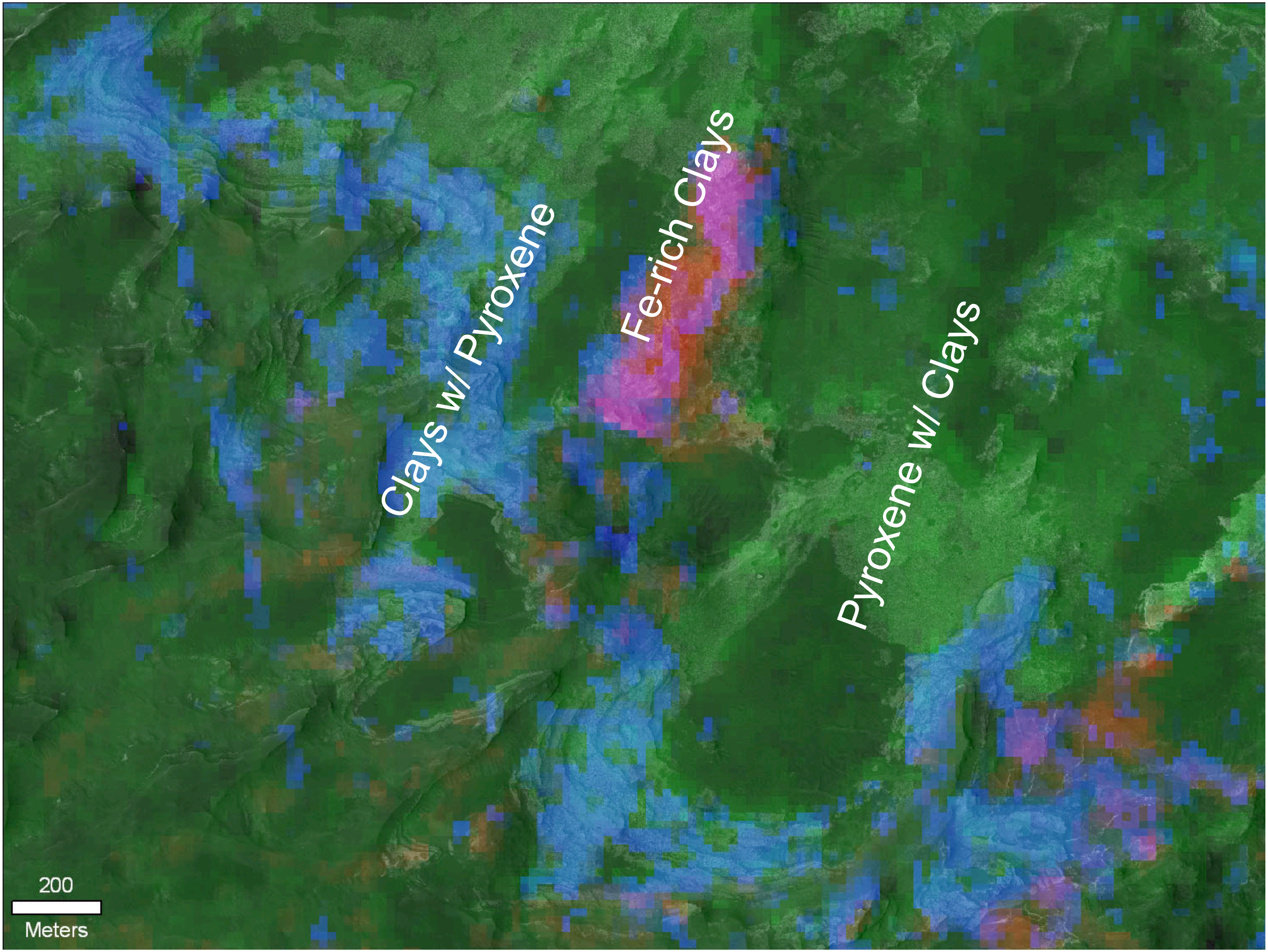
- Pyroxene unit with clays

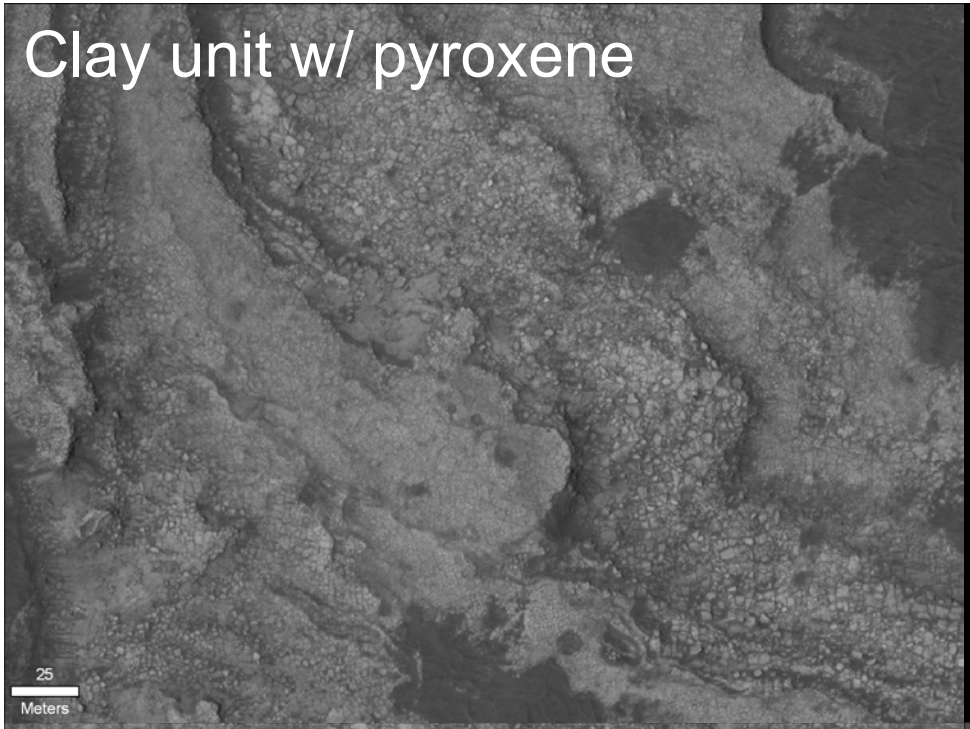
- Fe-rich clay unit






200
Meters


Clays w/ Pyroxene
Fe-rich Clays
Pyroxene w/ Clays
200
Meters



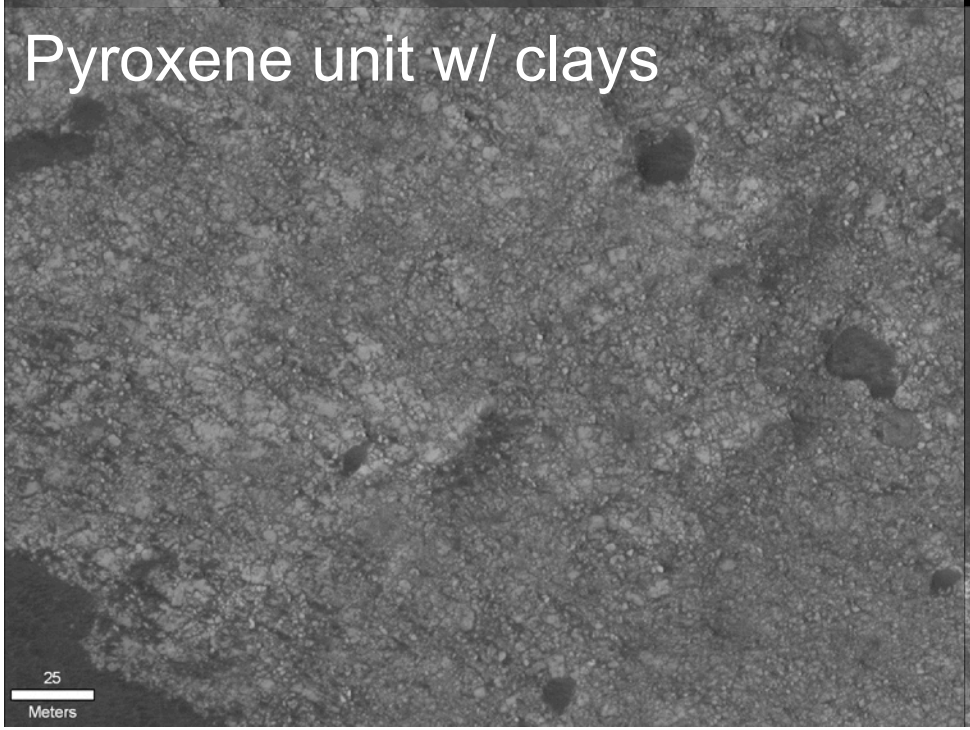
All units exhibit fracturing to some degree.

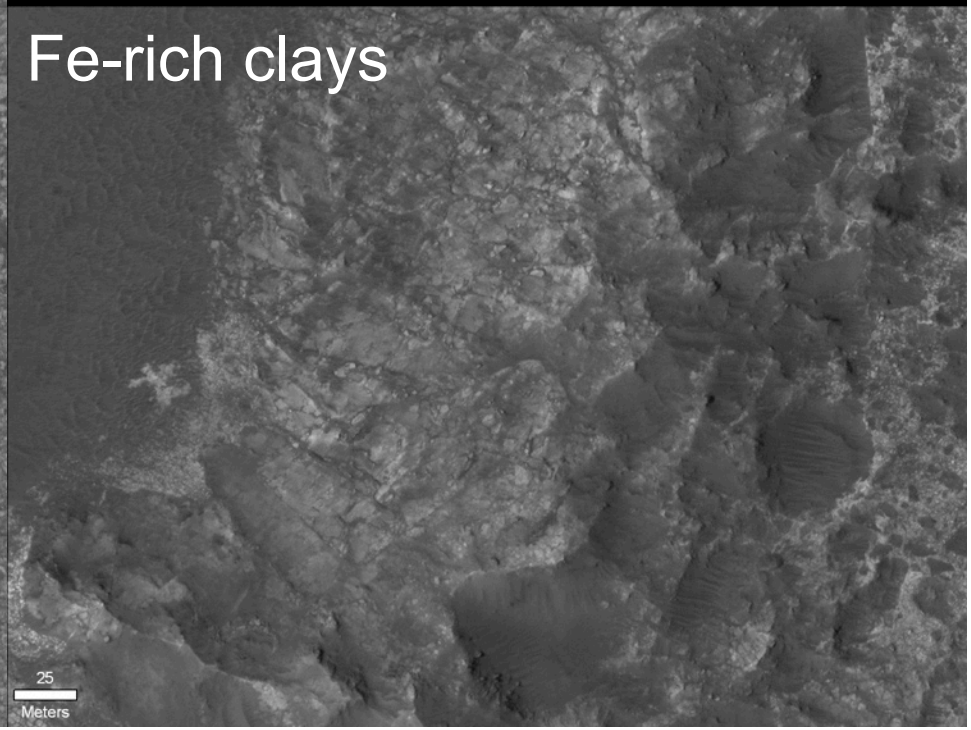
The ‘clay-rich’ units are more variable in their degree of fracturing.

The Fe-rich clay is primarily associated with ejecta from Holden crater:

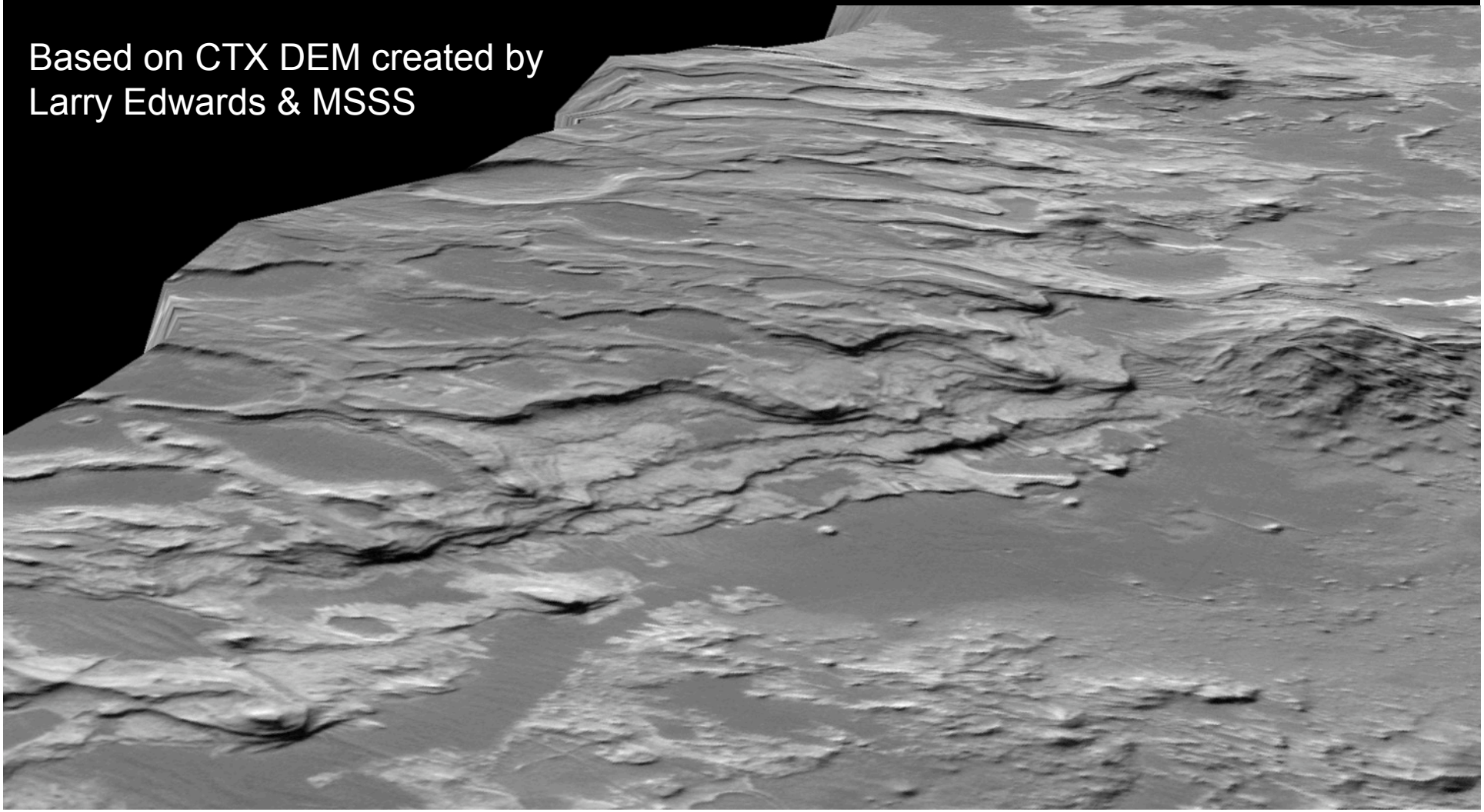
1) The Fe-rich clay formed *in situ* under reducing conditions in mafic-rich ejecta.

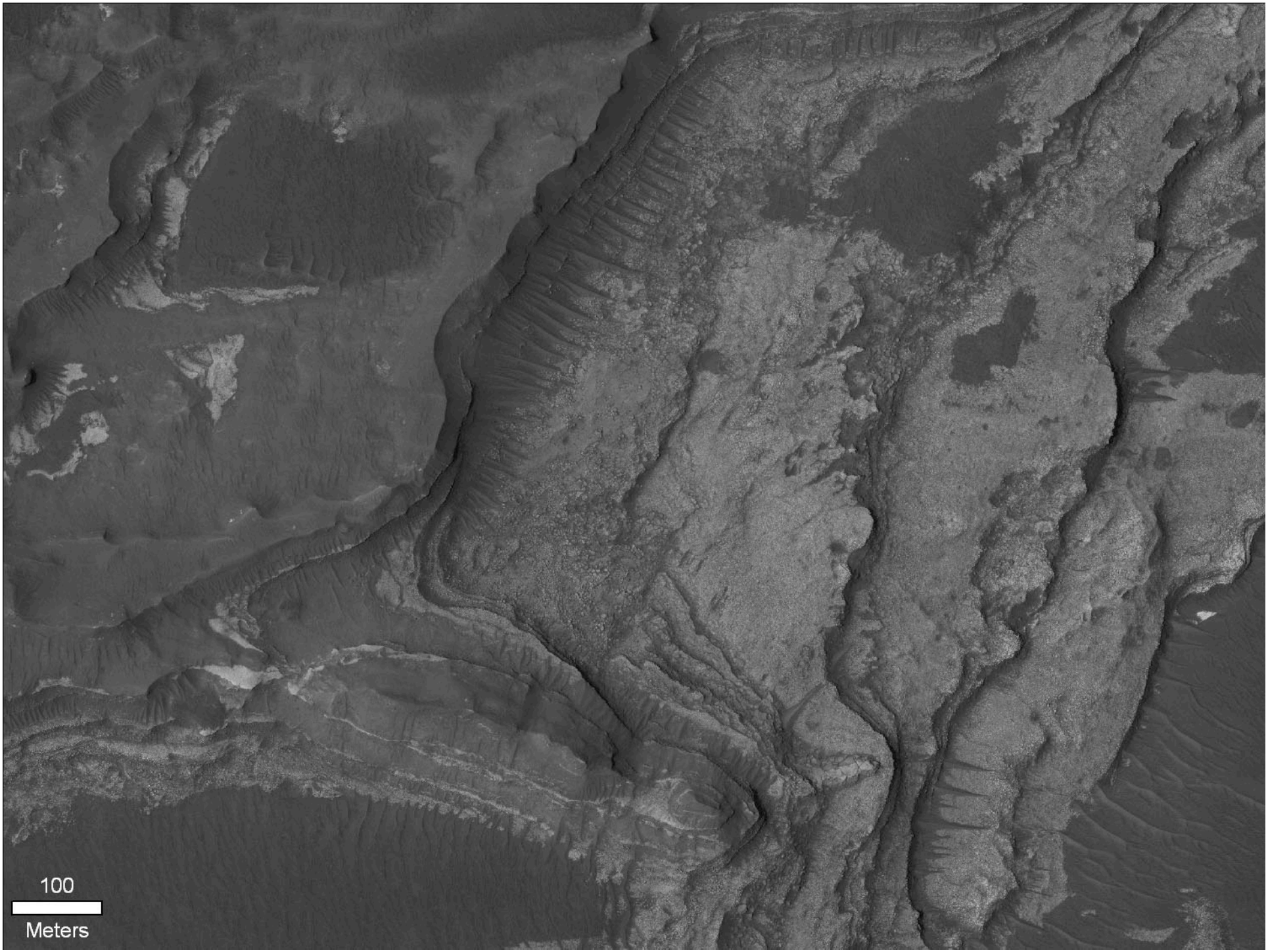
2) The Fe-rich clay was in pre-existing material ejected from Holden Crater.

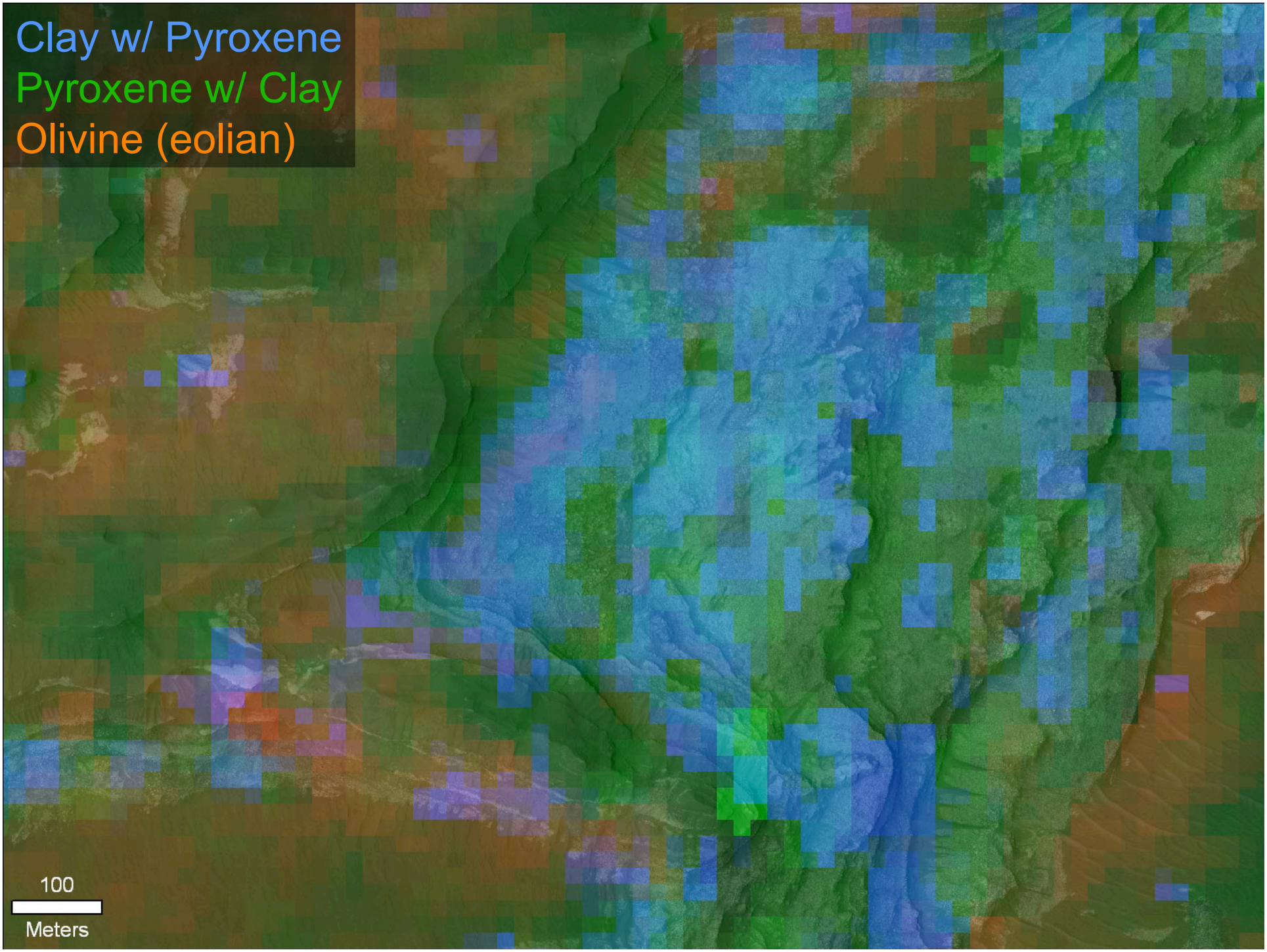


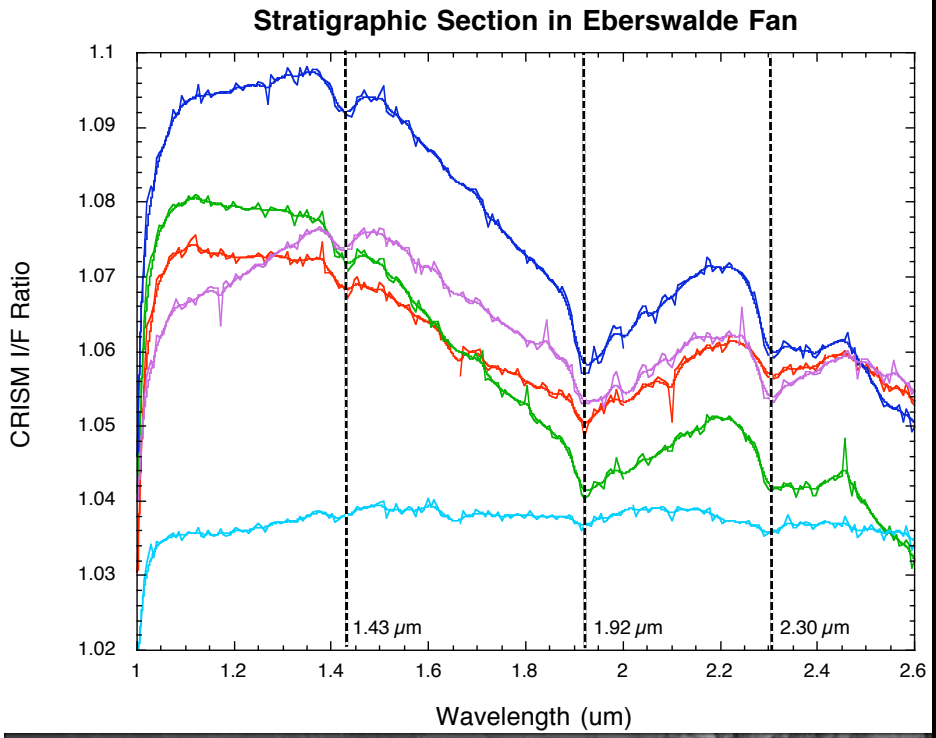


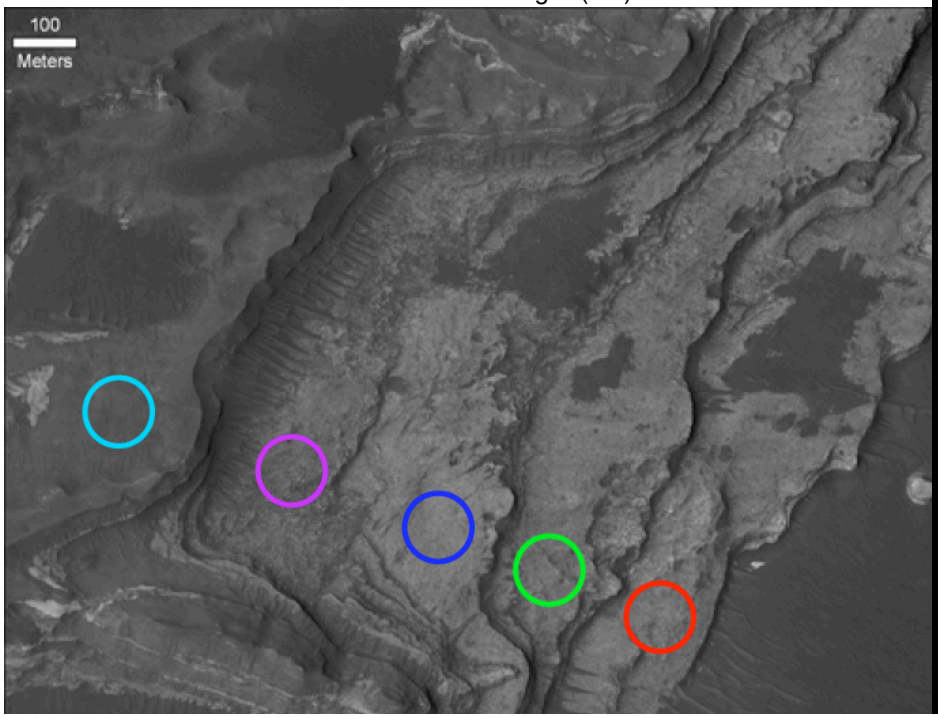
Deltaic units eroded along bedding planes can be used to average CRISM pixels to look for subtle variations in the strength of the clay signatures.




100
Meters


Clay w/ Pyroxene
Pyroxene w/ Clay
Olivine (eolian)
100
Meters





Spectra are most consistent with Fe/Mg smectites (e.g. nontronite, saponite), **but chlorite may also be present.**

Spectral signatures are strongest in the middle & lower light-toned beds; pyroxene (LCP) is also present.

Clays are found in the stratigraphic units where you would expect them in a deltaic setting.

If some of these beds are intact siltstones or mudstones, then their occurrence as rock outcrops instead of particulates may explain the weak spectral signatures (even though they have a high clay content) compared to other landing sites.

Mineralogy of Eberswalde

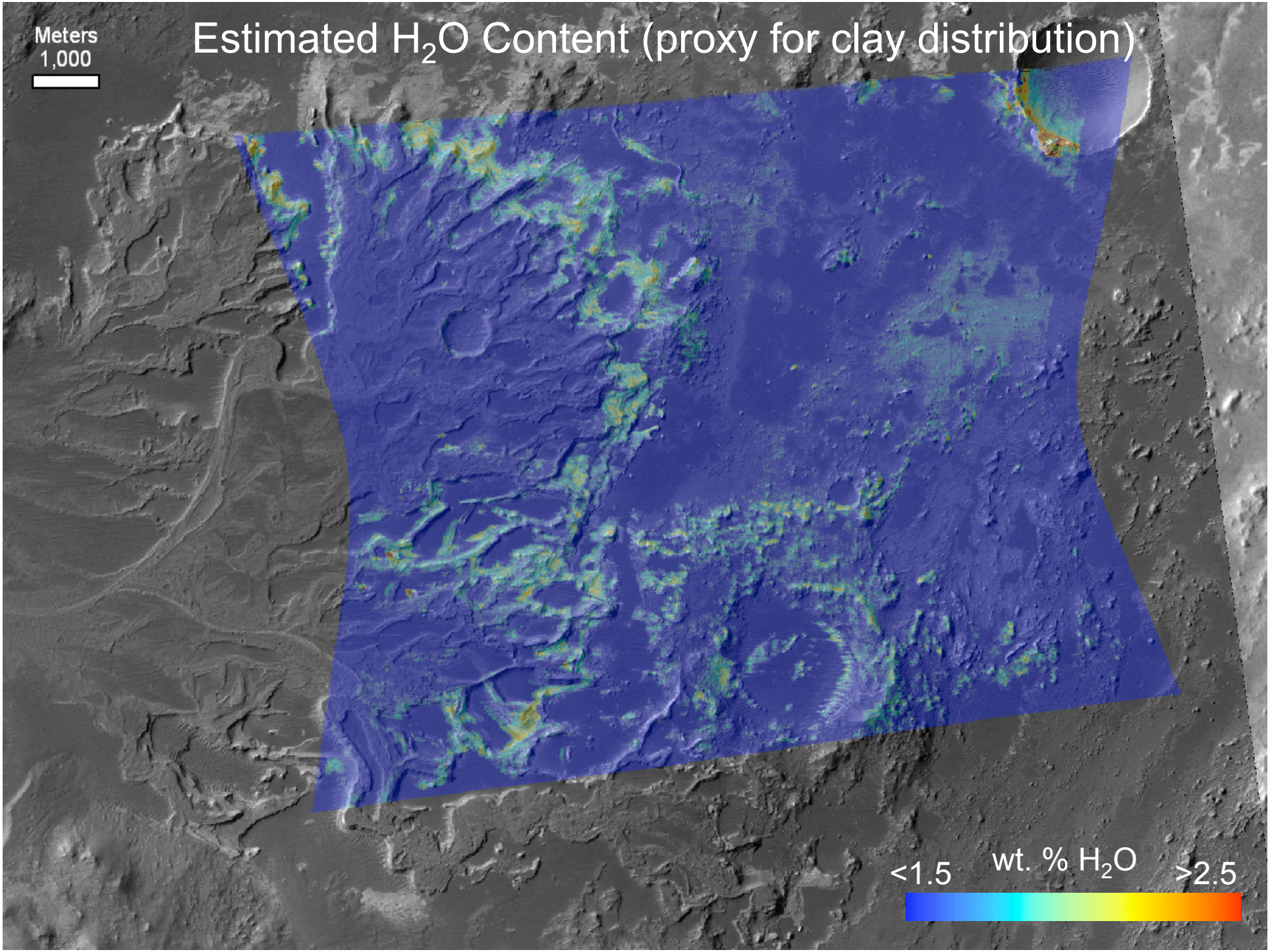
Clay minerals (Fe/Mg smectite & possibly chlorite) are present in the landing ellipse and in the deltaic units.

Clays in the bottomset and foreset units of the delta are likely detrital and our terrestrial experience tells us that these units can have high clay abundances.

Clays (Fe-rich smectites) indicative of reducing conditions are present in Holden Crater ejecta….*in situ* clay formation?

Moderate pH (8-9) and reducing conditions are favorable for life and preservation of organic material.

The mineralogy in Eberswalde is consistent with the morphology; deltaic environments with clays are excellent places to assess habitability.


Meters
1,000
Estimated H_2O Content (proxy for clay distribution)
<1.5
wt. % H_2O
>2.5